On two species of Lac Insects and a confirmation of Swagerman's observations

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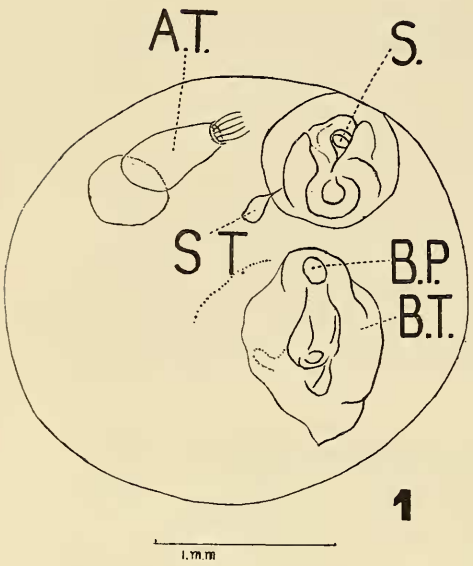
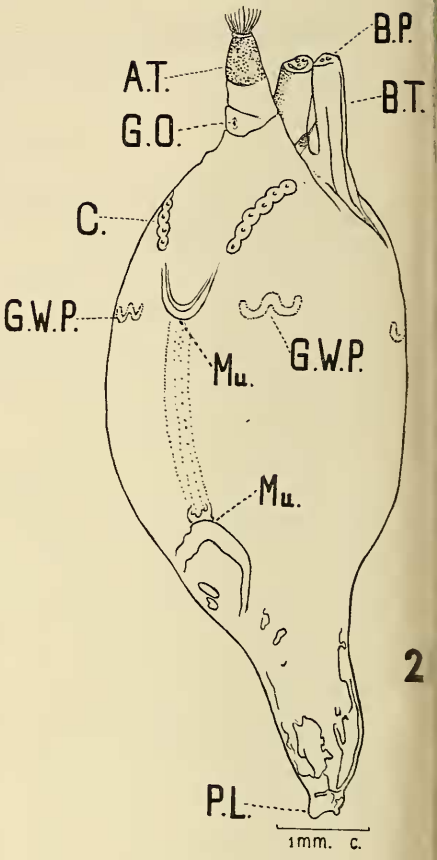
Lac insects are regularly propagated in India. According to an official calculation the total production of lac per year amounts roughly to 48,000 tons (1). However it is an industry which utilises more than one species of insect, for lac does not grow on every tree nor everywhere But since the existence of more than one species of the lac insect is not recognised, it only shows the nature of the difficulties in classifying them. For example as early as 1899, Lt. Col. A d a m s observed that the lac insect of Rajputana had red as well as yellow forms. This insect was subsequently named *Lakshadia fici* by G r e e n. But even this insect has not yet been recognised as an independent species, as I have already pointed out ten years ago (2).

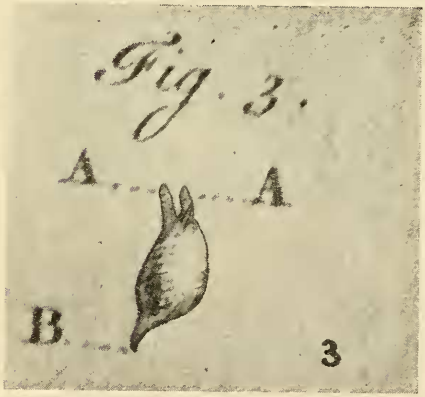
Perhaps the first to realise that there were more than one lac insect was S w a g e r m a n of Amsterdam, whose communication (3), accompanied with illustrations, appeared in 1780. He recognises three varieties of lac according to their geographical source. In paragraph 24, he writes to the following effect. There are three important sorts of lac, that coming from Siam, from the Coromandel coast in Madras and from Bengal as it was known then. That from Siam is the best. Somewhat inferior to it is the product of the Coromandel coast, although it approaches the Siamese product. That of Bengal is the worst because it yields the least amount of lac dye, which was more costly then than the lac resin, which, alone, has any value now. S w a g e r m a n is perfectly correct in his differentiation. He continues, in paragraph 25, to say that the variety from Bengal is the most translucent and of *yellow* colour. The Coromandel product distinguishes itself from that of Bengal, the former being *dark red* when seen against light. But when compared with the Siamese material it is this lac which is *darkest* in colour. I can confirm this statement as well ; the Bengal insect is now named *Lakshadia nagoliensis,* the Coromandel insect *L. communis*, the Siamese species *L. chinensis.*

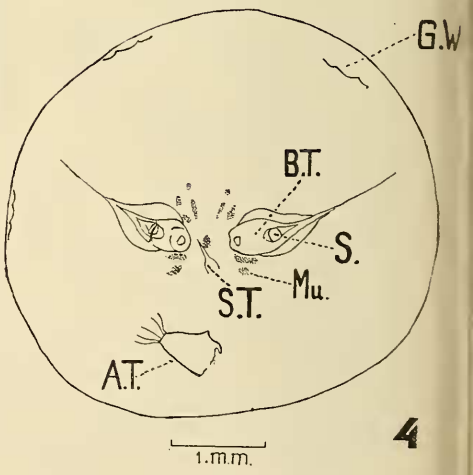
When the dye content, or laccaic acid, is considered, the above order of S w a g e r m a n holds perfectly correct, the Siamese, or *L. chinensis*, being the richest and *L. nagoliensis* the poorest in dye content. The dye is found within the insect body ; the insect also secretes a resin which purified comes on the market as shellac. The resin however has got a yellow dye, erythrolaccin, which, when present in sufficient quantity, gives lac a reddish appearance. The case is similar to melanin in different strengths causing reddish, brown and black hairs in human beings. When we consider the product of the three species which S w a g e r m a n observed, his remarks are justifiable, for where there is more lac dye within the body, there is also more erythrolaccin in the resin secreted.

It is proposed here to deal in some detail only with two species of the three insects he mentions. These have been already explained (4) by illustrating their raw products but here the insects themselves may be figured particularly to confirm S w a g e r m a n's illustration. The two species to be considered are *Lakshadia nagoliensis* and *L. communis*. The lac insects are normally gregarious and form a colony with a common encrustation, a sort of honey-comb which includes many insects. But the insect can grow isolated, in which case the shape of the body is round and its cell resembles a sphere. An individual insect of the species *L. nagoliensis* was growing isolated on Schleichera trijuga, at Raipur, in









Central Provinces, at the end of the rainy season and was collected in July. After treating it with caustic soda, to dissolve the soft parts, Fig. 1 has been drawn. The lac insects have two special characters; the Spinoid Tubercle, S.T., and a chitinised pair of tubes, the Brachial Tubercles, B.T., which incorporates the major spiracles. These two features are most developed in *L.*

nagoliensis. Fig. 1 shows its well developed and broad Brachial Tubercles very well.

When insects are growing in a colony they develop in length. Fig. 2 shows such an insect, from the same tree and locality as Fig. 1, but collected at the end of the monsoon season, about January. The body is elongated ; the Brachial Tubercles here are long and not broad as in Fig. 1, but still very well developed. The picture was taken without the insect being treated with alkali but nearly after the encrustation was dissolved in alcohol. The Spinoid Tubercle is partly hidden from view but its length can be compared with that of *L. communis* to follow.

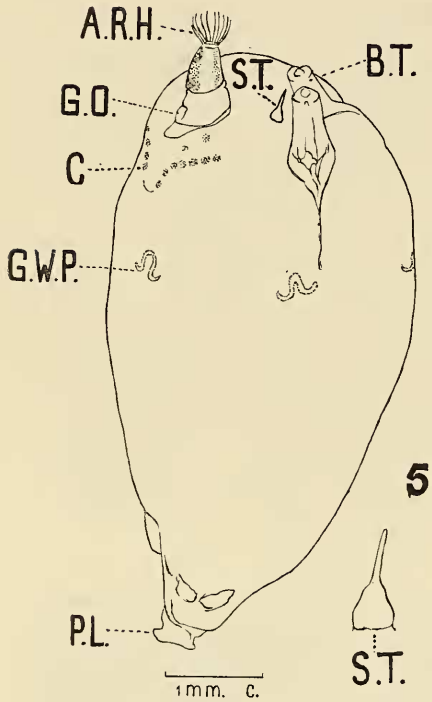
Fig. 3 here is a reproduction from Swagerman, whose picture also bears the same number. The Brachial Tubercles, B.T., in Fig. 2 have to be compared with Swagerman's indications "A" for the same objects in Fig. 3. Both in Figs. 2 and 3 these Tubercles are very long, longer than what is found in any other lac insect. The general appearance of the insect in Fig. 2 compares very well with that of Fig. 3 and it should be remembered that Fig. 3 was made by Swagerman from a dried and old specimen of lac, while mine was made from a fresh insect dissolved in alcohol. When these differences are taken into account the identity should be even more apparent, but it is a thing to be reckoned and to be observed, but even what we see is almost identical, Figs. 2 and 3 compare very well. Fig. 3 of Swagerman indicates with "B" the ventral pointed end where the head lies within. Even this part of the body is very similar to that seen in Fig. 2.

In 1790, Roxburgh found lac growing wild on the Coromandel coast which he illustrated and described (5). This species has been named *L. communis*. Stick-lac from this insect and from *L. nagoliensis* have been already illustrated (4) before, so that it is left for their respective insects to be compared with each other. Fig. 4 shows a full grown female cleared with caustic solution. It was found growing isolated on Anona squamosa, at the end of the monsoon season in Bangalore. The Spinoid Tubercle is relatively small when compared with that seen in *L. nagoliensis*, Fig. 1, Likewise the Brachial Tubercles in Fig. 4 are poorly developed as contrasted with those of *L. nagoliensis*, Fig. 1.

For comparison with Fig. 2 a specimen of *L. communis* growing on *Ficus mysorensis* at the end of the monsoon season at Bangalore was treated with alcohol and Fig. 5 drawn ; it came from an encrustation and hence shows an elongated body. The Spinoid Tubercle is small and to show how small it is this object is shown enlarged separately on the lower portion at the right side. Figs. 2 and 5 are drawn to the same scale. The Brachial Tubercle is much smaller in *L. communis*, Fig. 5, than in *L. nagoliensis*, Fig. 2.

A Brachial Tubercle of *L. nagoliensis* growing isolated has been drawn rather enlarged, as such an object has not been illustrated before. Only in *L. nagoliensis*, the Brachial Tubercles are very well developed, as is seen in Fig. 6. It is shown after clearing it with caustic and from outside. The spiracle is situated within a rim of thickly chitinised skin, the Peritreme. On one side of the Spiracle there is a furrow, F, being skin poorly chitinised. It marks a fold where the skin is not in the same level. The insect skin has pores of glands that secrete lac resin, some of these pores are indicated as lac pores, L.P. From the Peritreme towards the ventral side the chitinisation of the skin shows a bifurcation, B.F. In the species *L. chinensis* there is no such bifurcation, but a chitinisation continuous with the peritreme which gives it a linear appearance.

When a lac insect grows in a colony its appearance is represented by Fig. 2. From such a specimen of *L. nagoliensis* after treatment with caustic Fig. 7 has been drawn. The object is seen from within the insect



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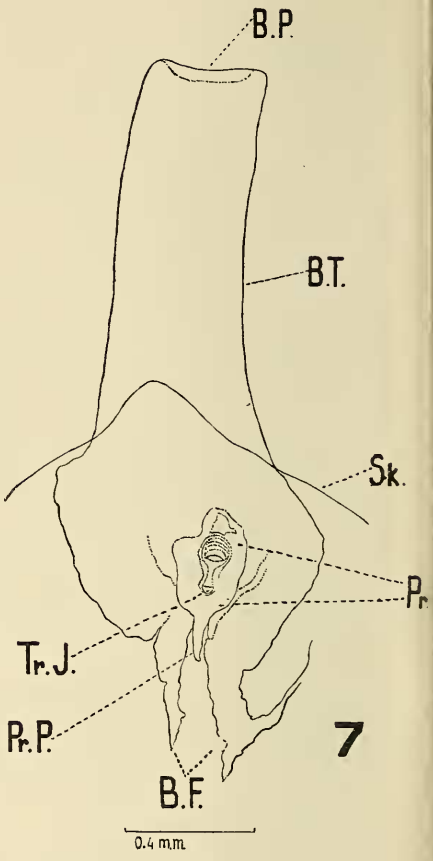

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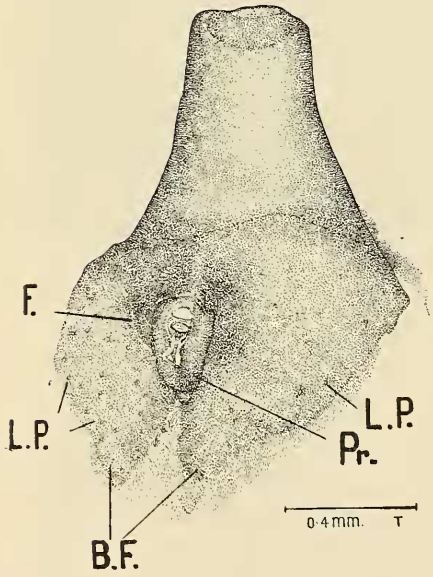

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body, as distinct to that shown in Fig. 6. The elongated Brachial Tubercle, B.T. confirms the illustration of S w a g e r m a n, Fig. 3 and thus Fig. 2 also belongs to the same species. Such long Brachial Tubercles are not seen in any other species than *L. nagoliensis*. The skin is indicated as Sk. The Peritreme is best seen from inside. The Peritreme, Pr., incorporates the trumpet-shaped spiracle, the portion where the tracheae are collectively attached is indicated as tracheal joint, Tr. J. The Peritreme shows towards its ven-

tral end a long fingerlike projection, the Peritreme process, Pr. P. The peritreme is on a different level than the surface of the skin, due to its being very thickly chitinised. The main surface of the skin, where the Brachial Tubercle ends towards the ventral side, shows a bifurcation in the chitinisation B. F., comparable with B.F. in Fig. 6. This is not always present as is seen in Fig. 1. Its value is best appreciated in studying *L. chinensis*, which will be dealt with in a future communication.

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SUMMARY.

In 1938 stick-lac or encrustation formed by the lac insects *Lakshadia nagoliensis* and *L. communis* have been compared. In the present communication their respective insects are illustrated to show their specific characters. Incidentally it confirms the observation of Swagerman who, in 1780, stated that there are more than one sorts of lac and even illustrated the insect *Lakshadia nagoliensis*, which is reproduced as Fig. 3, in the text here.

EXPLANATIONS OF FIGURES.

Fig. 1. *Lakshadia nagoliensis*, growing isolated, with broad and well developed Brachial Tubercles, B.T., and a large, Spinoid Tubercle, S.T. The Anal Tubercle is A.T.

Fig. 2. *Lakshadia nagoliensis*, growing in a colony, with an elongated body. The Brachial Tubercles, B.T. are long but still well developed. Spinoid Tubercle is not marked, but self evident.

Fig. 3. Swagerman's illustration published in 1780 ; it shows *Lakshadia nagoliensis* and compares with Fig. 2 here. His objects, marked "A", are Brachial Tubercles.

Fig. 4. *Lakshadia communis*, growing isolated, with smaller Brachial Tubercles, and an equally undeveloped Spinoid Tubercle, S.T. This illustration should be compared with Fig. 1 to realise the specific difference.

Fig. 5. *Lakshadia communis*, growing in a colony, with elongated body. The Spinoid Tubercle is small as compared with Fig. 2, and so are the Brachial Tubercles, B.T.

Fig. 6. Brachial Tubercle of *L. nagoliensis*, growing isolated ; it is well developed though broad.

Fig. 7. Brachial Tubercle of *L. nagoliensis* growing in a colony, it is again well developed, though long here.

EXPLANATION OF LETTERINGS IN THE ILLUSTRATIONS.

A.R.H. Anal Ring Hairs.
A.T. Anal Tubercle.
B.P. Brachial Plate, a plate of fused ducts exuding wax as filaments.
B.T. Brachial Tubercle bearing on the top, like a crater, the Brachial Plate.
B.F. Bifurcation, a fork-like chitinisation at the base of the Brachial Tubercle.
C. Circumgenital pores which exude hard wax.
F. Furrow-like thinly chitinised skin at the side of the spiracle.
G.O. Genital Opening.
G.W.P. Girdle Wax Pores which exude a special hard wax.
L.P. Lac Pores through which the lacresin is exuded; they are very minute.
Mu. Muscle-joint.
P.L. Posterior Lobe, at the oral end.
Pr. Peritreme, a chitinised rim around the spiracle.
Pr. P. Periteme Process, a finger-like elongation of the Peritreme towards the oral end of the insect.
S. Spiracle.
Sk. Skin, its margin.
S.T. Spinoid Tubercle.
Tr. J. Tracheal Joint. The Tracheae end, as attachment to the Spiracular opening, at this spot.